CENTRAL INTELLIGENCE AGENCY

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THE SOURCE EVALUATIONS IN THIS REPORT ARE DEFINITIVE.
THE APPRAISAL OF CONTENT IS TENTATIVE.
(FOR KEY SEE REVERSE)

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2. Several Soviet names have been improperly transliterated throughout the report and should be corrected as follows:

   Kusmin to Kuzmin,
   Kusnetzov to Kuznetsov,
   Wul to Vul, and
   Byelayev to Belayev.

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SUBJECT Condenser Development and Research Work at Lenin Zavod, Myza

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SUPPLEMENT TO REPORT NO. 50X1-HUM

THIS IS UNEVALUATED INFORMATION

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[redacted]

ORGANIZATION OF THE LENIN PLANT

1. The Lenin Plant was subordinate to the Ministry for Communications Equipment. [See page17]. The individual in the ministry responsible for the work of the plant was named TURTSHANIN. [redacted] 50X1-HUM

2. [redacted] the section concerned with the Development Department [redacted] [See page18]. The technical director of the plant was BYELAYEV. [redacted] KUSMIN was the Personnel Director. [redacted] The chief of [redacted] Development Department, beginning in 1948 was MALIKOV. [redacted] 50X1-HUM

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3. The chief of the Condenser Development Laboratory, [see page 19] [redacted] was IKONNIKOV. [redacted]

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4. Mrs. FOMINA was chief of the Resistor Development Laboratory. [redacted]

Laboratory Personnel

5. The Condenser Laboratory under IKONNIKOV was staffed by [redacted] 50X1-HUM German engineers: WERNER, WACHENHUSEN, BIERSACK [redacted] In addition, there were Soviet laboratory assistants [redacted] Two female chemical assistants [redacted] 50X1-HUM They had graduated from the Gorky University and were fulfilling the practical requirements of their curriculum. The other assistants in the laboratory were graduates of a technical institute. These assistants could hardly be compared to graduates of German universities or institutes. They are incapable of carrying out any independent development work. Nevertheless the official title of these graduates was "Diploma Chemist".

6. The Resistor Laboratory was staffed only by Dr. FALTER (now at Dralowidwerke, East Germany), and six to eight Soviet graduate assistants.

7. Dr. HOLZMUELLER (now Physics Professor in Leipzig) was assigned to the Ceramics Laboratory with two Soviet engineers, and six to eight graduate assistants.

8. No Germans were assigned to the Design and Drafting Section, which was staffed with four designers and four draftsmen. This section performed design work on machinery and apparatus required in the laboratories. The design work took much longer than it would have in Germany, and most of the actual machine design and construction had to be accomplished by the engineers before turning it over to this section. Ten Soviet

[redacted] 50X1

mechanics worked in the model shop under KUSNETZOV. 50X1-HUM 50X1-HUM

CONDENSER DEVELOPMENT LABORATORY IN LENINGRAD

9. Since the designers spoke some German [redacted] there was hardly any language problem between the sections. IKONNIKOV had two interpret[redacted] 50X1-HUM to translate all our papers and drawings. [redacted] also used the interpreters to speak to IKONNIKOV, although IKONNIKOV could speak German but chose not to. Apparently most of the Soviet executives could not speak German "officially". Mrs. FOMINA was an exception as she spoke German [redacted] 50X1-HUM

10. [redacted] never had direct contact with personnel of the Ministry for Communications Equipment. Four or five times [redacted] had visitors from this ministry. However, they were never introduced [redacted] and [redacted] never talked to any of them. [redacted] all of the men were from the ministry, but some may have been from other capacitor plants. None of the visitors were ever dressed in a military uniform. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

11. There was a similar condenser development laboratory locate[redacted] in Leningrad which IKONNIKOV considered [redacted] competitor. He sometimes indicated [redacted] what was going on at this laboratory in order to stimulate a spirit of competition [redacted] This was not too successful. At first most [redacted] at the Lenin Plant were quite eager to work, but as time went on [redacted] morale dropped as [redacted] realized that [redacted] being exploited, and were not considered individually. In addition, the many procurement problems, and the fact that [redacted] had to do a certa[redacted] amount of machinery design work which was not really in [redacted] field gradually decreased [redacted] interest and ambition for [redacted] work. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

12. The personnel at the plant in Leningrad consisted partly of Germans who had been sent from the Siemens Plant in Gera. These included FUNK, KALB and PILGRIM. Some of the machinery in this laboratory was sent there from the plant at Gera. [redacted] 50X1-HUM

DEVELOPMENT PROJECTS

Condenser Laboratory

13. [redacted] first project early in 1947 was to prepare a report on the current status of German capacitor developments. This project originated with an agency in Moscow, presumably the Ministry for Communications Equipment. A similar report was to be written on resistors by Dr. FALTER. The preparation of these reports was to consume approximately two weeks, but actually it took somewhat longer. Later the reports came back with questions on a few details. 50X1-HUM

14. [redacted] 50X1-HUM

[redacted] 50X1

[redacted] 50X1-HUM

Metallized Paper Capacitors

15. This work actually began in March 1947. Manufacturing equipment had arrived from OSW (OBERSPREEWERK - now WERK HF), and was to be installed in the laboratories. (This equipment had originally been used at the Siemens Plant at Gera, and was transferred to OSW at the end of World War II.) Most of the equipment was not in operating condition as pieces were broken and parts were missing, [redacted] first task was to make it operable. Some of the equipment necessary for making capacitors was not shipped from OSW and had to be built to [redacted] specifications at the Lenin Plant. 50X1-HUM 50X1-HUM

16. The vapor deposit apparatus used for producing metallized paper had been sent from OSW. It was designed for the following operation: A roll of lacquered paper is mounted under a vacuum dome. At a vacuum of between 0.01 and 0.02 millimeters of mercury, the paper is transferred from its original roll to another, and between the two rolls a film of zinc is deposited on it. The zinc is contained in anelectrically heated dish so that its vapor rises onto the paper. The paper runs at a speed of several meters per second. A roll of 8 microns thick paper, weighing between five and eight kilograms, would be run off in approximately 15 minutes. The thicknesses of the zinc deposit is approximately 0.1 micron. The zinc vaporizing dish is slightly wider than the paper strip. The running speed of the paper is controllable through the voltage applied to the DC motor which runs the roll. Before the paper is wound on the second roll it runs over two rollers which make electrical contact with the metallized surface and the resistance of the film between the rollers is automatically measured by a bridge circuit. Adjustments in the paper's running speed may be made to maintain the correct unit resistance. The standard resistance for a strip one centimeter long by one centimeter wide was to be approximately one ohm. The standard German resistance and layer thickness specifications were used [redacted] in the USSR. 50X1-HUM This metallizing process originated at Robert Bosch GmbH, and was used during the war by Siemens at Gera.

17. The next piece of machinery required for the manufacture of MP capacitors is a cutter to cut the 120 millimeter metallized paper strip into four strips, 30 millimeters wide. This cutter had to be built at the Lenin Plant. It is very important to control the width of the strips accurately; this was accomplished by careful mechanical construction. Razor blades were used to perform the actual cutting.

18. The paper cutter was set up outside of the vacuum dome. The construction of this machine actually proved to be a problem as the complete design had to be accomplished [redacted]. It was impossible [redacted] to tell the design section that [redacted] wanted a cutter to produce the required results. Being con- 50X1-HUM 50X1-HUM 50X1-HUM

 [redacted] 50X1

denser specialists [redacted] expected to know all phases of condenser manufacture and to be able to design all required machines and tools. For example, IKONNIKOV seriously believed that a condenser winding made by a man with a doctor's degree would be far superior to one made by a factory worker whose specialty is to wind capacitors. He was always very disappointed when [redacted] had difficulties with certain manufacturing details because [redacted] had had no experience with this type of work. Condenser winding machines had also been sent from Germany. [redacted] installed them and put them into operating condition. A small hand press was used to press the winding into a flat shape in accordance with the standard Siemens procedure. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

19. After pressing it is necessary to attach contacts to the electrodes of the capacitor. The chief advantage of metallized paper condensers is that when there are faults in the paper which may cause short circuits, the deposited metal at these points will "burn out", i.e. it will vaporize and become redeposited at adjacent points. For this reason it is not necessary to use an extra layer of plain paper for insulation between the two electrodes. However, this process eliminates the possibility of using ordinary insertion contacts as these could cause short circuits at faulty spots in the paper. For this reason the following procedure is required. When the metal is deposited on the 120 millimeter wide strip, narrow strips of paper run under the condenser paper to shield portions of it from the vapor. Thus when the 30 millimeter strips are cut, they are turned out with one unmetallized edge, and when the capacitor is wound the unmetallized edges of the two electrodes are on opposite sides. After pressing, a heavy zinc coating is sprayed on both ends; thus each end makes contact with one of the electrodes. Terminal wire is then soldered to the zinc coating. The zinc coating is sprayed on over a template so that holes will remain to permit impregnation of the winding. A compressed-air spray gun was used for applying the zinc coating.

20. After the electrodes are connected to the capacitor windings, the windings have to be dried and impregnated. The impregnation apparatus had to be built at the Lenin Plant as none was sent from Germany. [redacted] used two iron kettles; originally [redacted] wanted to use glass, but the necessary facilities and material were not available. The windings are placed in a basket inside one of the kettles. The kettle is then evacuated to remove all moisture from the windings. The impregnation material is melted in the other kettle. [redacted] used Ceresin which is obtained from an earth wax, "Ozokerit", which is similar to paraffin. The Ceresin was obtained from Soviet sources, but had the same qualities as the German material. Paraffin is not used as an impregnation material because it crystallizes, and would then permit moisture to get back into the winding. 50X1-HUM 50X1-HUM 50X1-HUM

21. A pipe connects the two kettles and the Ceresin is sucked into the winding kettle by maintaining lower pressure in

 [redacted] 50X1

the winding kettle. The winding kettle is also heated during this time. After the Ceresin has impregnated the windings the temperature is gradually reduced to room temperature and the pressure increased so that the windings may be taken out of the kettle. The pressure in the winding kettle was approximately 0.1 millimeter of mercury. An oil pump was used to create the vacuum. The kettles had a diameter of approximately 20 centimeters, and were 30 centimeters high.

22. After impregnation the windings are subjected to a series of voltage applications in order to burn out the short circuit spots in the metallized paper. A carrousel machine with slip rings was used to apply the voltages systematically. To limit the amount of electrical discharge through the short circuit points, the voltage application was obtained from charged capacitors. The final applied voltage was about twice the rated condenser voltage.

23. The winding is then measured for correct capacitance value. The tolerances which [redacted] had to maintain were usually plus 20 50X1-HUM
and minus 10 per cent. It is thus possible to obtain the correct capacitance by controlling the length of metallized paper used for the winding, and no changes have to be made by adding or cutting off small pieces of metallized paper.

24. The finished windings were mounted in small rectangular iron housings with impregnated pressboard stand-off pieces. Glass pearls were used for contact feed-throughs. Several thousand of these had been sent from Germany along with our other equipment; they probably had been produced by Schott and 50X1-HUM
Genossen, Jena. Later [redacted] received Soviet glass pearls which met German specifications in every way. At first difficulties were encountered due to low insulation resistance but this improved later. [redacted] never had any problems with 50X1-HUM
respect to the coefficient of expansion of the glass pearls. The pearls were soldered into the top cover of the housings.

25. The housings were usually not impregnated but merely sealed by soldering. [redacted] 50X1-HUM
a number of the samples were impregnated with Ceresin in the impregnation kettles by leaving two small holes in the case. These would then be sealed by soldering.

26. The laboratory had test equipment for measuring capacitance, insulation resistance, and power factor.

27. [redacted] made capacitors having values of 1, 2, and 4 microfarads. 50X1-HUM
At first [redacted] made them only for rated voltages of 160 volts, 50X1-HUM
later for 250 volts, and [redacted] finally succeeded in 50X1-HUM
making some for 500 volts. The higher voltage ratings required a thicker dielectric, which was obtained by using thicker paper to be metallized, or by inserting an extra nonmetallized sheet. Eight micron paper was used for the 160 volt ratings, and [redacted] we had 12 micron paper for the 50X1-HUM
250 volt rating. Double layer windings were used to make capacitors for 500 volts.

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[redacted] 50X1-HUM

28. One aim of our program was to develop manufacturing methods for producing MP capacitors using Soviet materials. However, no Soviet capacitor paper was ever available [redacted] at the Lenin Plant, so [redacted] no opportunity to work on this phase [redacted] 50X1-HUM 50X1-HUM

29. The dimensions for [redacted] MP capacitors were in accordance with German DIN specifications. The case for a one microfarad capacitor was approximately 5 to 10 millimeters high, 30 millimeters wide, and 35 millimeters long. The dielectric constant of the paper [redacted] used was 4.5 or 4.6 after impregnation. 50X1-HUM

30. [redacted] All procurement is controlled by agencies in Moscow, and apparently no shipments are made directly from the source to the consuming plant. 50X1-HUM 50X1-HUM

31. Each phase of [redacted] work was concluded by a very detailed report and production of samples. The reports were to include complete manufacturing instructions and specifications for the production of these samples.

32. No frequency characteristics were specified for the metallized paper capacitors. [redacted] merely given specifications on capacitance values and operating voltages. [redacted] occasionally saw and used Soviet Gost norms which differ in minor respects from DIN specifications, but definitely seem to be patterned after them. The Gost norms put much emphasis on relatively unimportant details such as case dimensions, contact configuration, etc. [redacted] were supposed to suggest desirable changes for the Gost norms, but [redacted] never made any important suggestions. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

33. Otto BIERSACK [redacted] conducted work on MP capacitors throughout [redacted] stay at the Lenin Plant, simultaneously with the work on Styroflex and electrolytic condensers. It was desired that [redacted] also work on developments for mica and ceramic condensers, but since none [redacted] had had any experience in these fields no work was ever done on them. IKONNIKOV was quite disappointed that [redacted] were unable to tackle the ceramic condenser field, as he had had some background in ceramics. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

34. In addition to the final project reports, annual reports were prepared in great technical detail to serve as complete progress reports on [redacted] work. [redacted] received samples developed at the Leningrad laboratory for evaluation. They appeared to be very similar [redacted] products. Presumably [redacted] reports and samples were similarly sent to Leningrad for their evaluation prior to being submitted to the Ministry in Moscow. 50X1-HUM 50X1-HUM 50X1-HUM

[redacted] 50X1

ELECTROLYTIC CORROSION INVESTIGATION AND LIFE TESTS

35. [redacted] carried out one project which was [redacted] own proposal. This was a basic scientific investigation of the causes and processes of electrolytic corrosion. IKONNIKOV appeared quite interested in this work. Tests were made by placing the windings in humidity cabinets with applied DC voltages. The relative humidities varied from zero to 100 per cent. Electrolytic corrosion appeared on the positive electrodes of the windings. When no voltage was applied to the capacitors considerably less corrosion took place and, of course, it was distributed equally on both electrodes. [redacted] interested primarily in how these processes come into being, i.e. how the zinc salts are formed to start the corrosion. [redacted] no investigations of this type had been carried out previously in Germany. [redacted] also interested the aging characteristics of Ceresin and its reactions with zinc when corrosion takes place. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

36. [redacted] investigation never progressed so far as to result in suggestions for improving the resistance to corrosion of MP condensers. It was debated whether to use another metal, such as aluminum, instead of zinc. However, aluminum has a much higher vaporizing temperature which would cause considerable difficulties in the depositing processes as the paper would be apt to burn. [redacted] did make some calculations to determine what would be required for an aluminum depositing process, but no practical work was carried out on this. The corrosion project was terminated by a scientific report on [redacted] findings, including [redacted] ideas on the exact corrosion process. [redacted] this was an entirely new study for the Soviets. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

37. Life tests were performed on [redacted] capacitors in ovens at temperatures of 60 or 70 degrees centigrade. [redacted] they were on the order of several thousand hours at this temperature. [redacted] capacitors generally met the specifications. The capacitors were placed in the ovens with an applied voltage, and periodically the capacitance leakage current would be measured. Accelerated life tests using higher applied voltages were debated, but not carried out as there was considerable skepticism as to their actual value. 50X1-HUM 50X1-HUM 50X1-HUM

STYROFLEX CONDENSERS

38. Styroflex foil was shipped [redacted] from Germany, and [redacted] never saw any Soviet Styroflex. IKONNIKOV once mentioned that it was produced in the USSR, but none of it was made available [redacted] 50X1-HUM 50X1-HUM

39. Initially we made metal-Styroflex capacitors using windings of Styroflex and aluminum foil. The Styroflex is stretched by the producer prior to rolling it for shipment. After the capacitor winding is made, it is "tempered", i.e. subjected to 90 - 95 degrees centigrade for a period of 24 hours. This causes the Styroflex to "destretch" or to pack itself tightly. For this reason it is not necessary to impregnate these Styroflex condensers. The Styroflex foil [redacted] used was 20 microns thick, and the aluminum was 7 to 8 microns thick. [redacted] 50X1-HUM 50X1-HUM

[redacted] 50X1

tried in vain to obtain 6 micron aluminum foil, as this is very difficult to produce.

40. The main features of Styroflex are its small loss factor, even at high frequencies (the losses are of the same order as for mica), good frequency characteristics, exactly defined negative temperature coefficients, and extremely high insulation resistance. The Styroflex condensers using aluminum foil require a double layer winding in order to cover up faults in the Styroflex which might cause short circuits. Thus size is sacrificed for excellent electrical characteristics.

41. To determine variations in temperature coefficients of capacitance, [redacted] ran temperature hysteresis loops from plus 60 to minus 40 degrees centigrade. The results were checked against Soviet norms which closely agreed with German specifications. 50X1-HUM 50X1-HUM

42. Occasionally [redacted] had difficulties with Soviet aluminum foil because it was not rolled evenly. [redacted] they improved gradually and finally were entirely satisfactory. [redacted] 50X1-HUM 50X1-HUM 50X1-HUM

43. The specified capacitance tolerance for these Styroflex condensers was ± 2 per cent. [redacted] asked to limit it to 1 per cent, but [redacted] this was too difficult. Small amount of Styroflex and aluminum foil may be added or cut off after the winding is made in order to approach the specified capacitance value more closely. 50X1-HUM 50X1-HUM

44. [redacted] the specifications indicated an operating voltage of 500 volts. [redacted] never accomplished this value in Germany because there were no requirements for Styroflex condensers above 200 volts. [redacted] were reluctant to try anything which [redacted] had not accomplished in Germany, because failure in an assigned project is frequently interpreted as sabotage by the Soviets. However [redacted] did succeed in producing condensers for the specified voltage, the tests being run at 50 to 60 degrees centigrade. [redacted] used several different thicknesses of Styroflex foil [redacted] 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

45. The Styroflex condensers were mounted in cylindrical cases as the windings are not pressed flat. The specifications also required a low temperature limit of minus 60 degrees centigrade. This exceeded the war-time German requirements of -40 degrees, but was attainable without difficulty. The specified temperature coefficient was -100 to -200×10^{-6} per degree centigrade (100 to 200 parts per million per degree centigrade). [redacted] never able to explain or solve satisfactorily the hysteresis variations in these capacitors. Capacitance was measured by a resonance measurement at high frequencies using a Q-meter. The complete test equipment included American as well as Soviet and German instruments. It was always a problem to obtain spare parts such as tubes for this equipment. The frequency requirements [redacted] went up to at least 1 megacycle. This was the highest frequency at 50X1-HUM 50X1-HUM

 [redacted] 50X1

which [redacted] made measurements. 50X1-HUM

46. The aluminum foil used for these condensers was 99.5 per cent pure. The purity of the foil for electrolytics [see below] was 99.8 per cent.

METALLIZED STYROFLEX CONDENSERS

47. IKONNIKOV requested [redacted] develop metallized Styroflex condensers similar to MP condensers. [redacted] were very reluctant to attempt this as [redacted] it would be difficult to prevent the Styroflex from becoming too hot during the metallizing process. Apparently [redacted] refusal to attempt this development was interpreted as economic sabotage, so [redacted] had no choice but to carry out the development. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

48. Very accurate control of the running speed of the Styroflex was maintained to overcome the problem of overheating. The samples [redacted] produced were definitely satisfactory. [redacted] The development was not entirely completed as there were still certain problems and debatable points on the manufacturing processes. 50X1-HUM

49. Approximately the same amount of zinc was deposited on the Styroflex as on paper. The temperature of the zinc was approximately 400 degrees centigrade. The running speed of the Styroflex was approximately the same as for paper, but it was run over a cooling device immediately ahead of and behind the vaporizing dish.

50. The burning out process of faulty spots in the Styroflex was carried out in the same manner as for MP condensers. Of course, there were fewer faulty spots on the Styroflex foil.

51. After burning out, the metallized Styroflex windings were tempered in the same manner as foil condensers. [redacted] did not find a satisfactory solution for the required adding or subtracting of winding sections to attain exact capacitance values. 50X1-HUM

52. [redacted] did not have time to investigate the electrical characteristics of these condensers. [redacted] main accomplishment was basically that [redacted] had found it to be possible to deposit metal on Styroflex by vaporization, and that we had obtained a satisfactory "burn out" effect. 50X1-HUM 50X1-HUM 50X1-HUM

53. [redacted] spraying zinc on the ends of the windings would cause the Styroflex to melt, but this did not occur and it was no problem at all to provide proper contact arrangements. 50X1-HUM

54. [redacted] used Soviet zinc for these as well as the MP condensers, and this proved to be entirely satisfactory. [redacted] 50X1-HUM 50X1-HUM 50X1-HUM

[redacted] 50X1

LOW-TEMPERATURE ELECTROLYTIC CONDENSERS

55. This development was carried on by WERNER [redacted] 50X1-HUM

56. Low-temperature electrolytic condensers were originally developed at Siemens. They use a special electrolyte, without paper, and the condensers are rated for a low temperature limit of minus 40 degrees centigrade with a loss in capacitance of only about 10 per cent. The development at the Lenin Plant was suggested by IKONNIKOV. It resulted in the production of a few samples, but [redacted] it was never entirely completed. 50X1-HUM

57. For these capacitors it was necessary to use a special forming bath for producing an oxide layer on the aluminum foil to absorb the electrolyte. The bath consisted of sulphuric acid through which the aluminum foil was run, with positive voltage applied to it. The oxide layer was thus formed on both sides of the foil.

58. The oxidized aluminum foil was wound and the finished winding impregnated with the electrolyte. The impregnation was accomplished in the same manner as the Ceresin impregnation of MP windings. A special electrolyte made on a glycol-ether base was used in these capacitors. This electrolyte was mixed at the Lenin Plant using Soviet chemicals. This was no particular problem, as it had been developed at Siemens by WERNER [redacted] WERNER did complain about the purity of the chemicals, but this had been a problem in Germany as well. 50X1-HUM

59. After the winding is impregnated with the electrolyte, it is reformed in order to reoxidize any points at which the oxidized layer might have become damaged. This forming is accomplished by applying voltage to the capacitors in series with a limiting resistance. The capacitor is again formed after mounting in its case to reoxidize points which may have become damaged due to riveting of the contacts to the electrodes.

60. The cases were made of aluminum, and the bases of hard rubber or some synthetic material. The base sits inside the bottom end of the can, which is then bent over to seal the can by means of a flat metal ring. This seal was somewhat questionable, but sealing with solder is not permissable as no foreign metals may be brought into contact with the electrolyte. The aluminum cans, as well as the bases were Soviet products.

61. The finished condensers were usable down to a low temperature limit of minus 60 degrees centigrade with a loss in capacitance of approximately 50 per cent. The high temperature limit was about 70 degrees centigrade. The upper limit is always a problem with this electrolyte as it has a comparatively low vaporizing temperature. The condensers were rated for approximately 100 volts.

62. Temperature life tests were made, but no humidity tests. The

 [redacted] 50X1

temperature characteristics were measured up to 60 or 70 degrees centigrade. The capacitance values made by WERNER were 8 to 10 microfarads. He never made any condensers with several sections in one can, as basically only the low temperature characteristic was of interest.

63. The low temperature electrolytics were approximately the same size as ordinary electrolytics for the same capacitance values.

64. [redacted] this project was turned over to the laboratory in Leningrad [redacted] The Soviets were not interested in [redacted] produce normal types of electrolytic condensers because they produced these already. WERNER did make some electrolytics using paper for comparison purposes and occasionally complained about the Soviet paper which he had to use. [redacted] had an opportunity to see several ordinary Soviet electrolytic condensers; they appeared to be perfectly satisfactory. [redacted] 50X1-HUM 50X1-HUM 50X1-HUM

IRON-ELECTROLYTIC CONDENSERS

65. These condensers had also been a development of Siemens. They used iron instead of aluminum and oxidized it in a sodium-hydroxide bath. Condensers made in this way have a capacitance approximately 1,000 times as high as ordinary electrolytic condensers of the same size; however, each plate can withstand a voltage of only 1.5 volts. The oxide layer should actually be considered a polarization layer rather than a dielectric. The exact reasons for this extraordinarily high dielectric constant are unknown. Round iron plates, 3 cm in diameter, were used in series to obtain an operating voltage of approximately 4 volts. The plates were mounted with a rubber edge around each one to seal the cell between them which contains the electrolyte. The electrolyte is sodium-hydroxide, and the polyvinylchloride shreds are used to absorb this electrolyte. The saturated shreds are then inserted between the iron plates. The finished condenser is mounted in a metal tube; a tube about 6 cm long could have a capacity of 10,000 microfarads. [redacted] 50X1-HUM

66. It was extremely difficult to control the characteristics of these condensers. The capacitance of a condenser of a certain size could, for example, be anywhere between 5,000 and 20,000 microfarads. WERNER never progressed any further with this development than the post-war German status, and was far from solving most of the control problems.

67. In addition to the manufacturing machines mentioned above, [redacted] had chemical analysis equipment for analyzing impregnation materials and electrolytes. [redacted] carried on some experiments with artificial aging of impregnation materials, but this work produced nothing beyond the general state of the art. [redacted] had a vibration table to test the Styroflex and MP capacitors in accordance with GOST norms. [redacted] There was no shock testing apparatus 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

 [redacted] 50X1

[redacted] the vibration table had provisions for varying the frequency and the amplitudes of the vibrations [redacted] 50X1-HUM 50X1-HUM

68. [redacted] no [redacted] trademarks on components produced by the Lenin Plant [redacted] merely wrote or stamped the capacitance and voltage values on [redacted] condensers. The Lenin Plant had a zavod number [redacted] but this was not stamped on the components. 50X1-HUM

69. The capacitors from Leningrad which we were given to evaluate were basically the same [redacted] noted at times that they were inferior in some respects, such as capacitance tolerance and loss factors. [redacted] took a few of them apart and they were made very similarly [redacted] made by Germans [redacted] seems fairly certain, since [redacted] Germans were at the laboratory at Leningrad. 50X1-HUM 50X1-HUM 50X1-HUM

70. During 1947 [redacted] some mica condensers made at the Lenin Plant. [redacted] they used metallized mica. They were not of very high quality [redacted] the mica was definitely not as good as German Mucovit Mica. The construction of the condensers was not very "clean". [redacted] color codes are used in the USSR. [redacted] on some ceramic tubular condensers. [redacted] they are similar to the German standards. 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

71. The ceramic condensers [redacted] were shown [redacted] by IKONNIKOV, but he did not tell [redacted] where they had been made. GOST specifications were available on ceramic condensers, and proposed norms were on hand for MP condensors. There were no norms for Styroflex, [redacted] never saw any for electrolytic condensers, but these may have been published. 50X1-HUM 50X1-HUM

RESISTOR LABORATORY

72. Dr. FALTER had equipment in his laboratory for manufacturing deposited carbon and metal alloy resistors. These used ceramic tubes on which the carbon or metal was deposited. [redacted] The capacitor was deposited in accordance with standard Siemens methods. The metal-deposited resistors were used for special applications where certain temperature coefficients were required. [redacted] Spiral-cut deposited carbon resistors were also produced in this laboratory. 50X1-HUM 50X1-HUM 50X1-HUM

73. All of the machinery in the resistor laboratory had been built at the Lenin Plant. [redacted] the quality of the resistors corresponded fully to similar German products. [redacted] the ceramic tubes were made in the USSR. FALTER never mentioned anything about their quality. FALTER may have surpassed the German status in the field of alloy deposited 50X1-HUM 50X1-HUM 50X1-HUM

 [redacted]

resistors, but in general he did not progress much further. Mrs. FOMINA, who was the chief of this laboratory, was technically quite capable, but FALTER frequently mentioned that, after all, "she is a woman".

CERAMICS LABORATORY

74. No ceramic condensers were made in this laboratory. Starting about the end of 1948 the main emphasis was on the development of ferrites. [redacted] HOLZMUELLER had had no previous experience in this field [redacted] HOLZMUELLER occasionally talked about his work. [redacted]

75. His work was concerned with producing ferrites for coil cores, but he was unable to obtain consistently good characteristics. He experimented with a number of different alloys. [redacted] The two Soviet ceramics engineers who worked with HOLZMUELLER appeared to be quite capable in their field. They were certainly far superior to IKONNIKOV. [redacted]

76. [redacted] HOLZMUELLER was taken off the train and sent back to the USSR. [redacted]

TECHNICAL PUBLICATION

77. The Soviets are very up-to-date on foreign technical developments which are published in books and periodicals. This is primarily true of American developments. There are several persons in Moscow who study foreign literature and publish their findings in Russian. A condenser specialist, RENNE, wrote an excellent book on condensers, which was based primarily on American literature. IKONNIKOV considered this book his "bible" on condensers. The first of RENNE's books was published in 1948. The second was published some time later and was far more up-to-date.

78. The Soviet periodical Elektrichestvo (Electricity) was generally available and could be purchased on newsstands. There have been a number of articles in this publication by RENNE which were essentially copies of American articles. A book on dielectric materials was written by SKANAVI, who is considered the foremost Soviet expert in this field. Barium titanate combinations, used to produce extremely high dielectric constants, were described in publications by WUL. Foreign literature [redacted] included current issues of Electronics and IRE Proceedings.

POSSIBLE PRODUCTIONS OF RADAR EQUIPMENT AT LENIN PLANT

79. [redacted] members of a group of German specialists,

 [redacted] 50X1

who had been sent from Bitterfeld to Dzerzhinsk. [redacted] 50X1-HUM
[redacted] The only other German specialists [redacted] in the USSR were a group of Germans on an excursion from Moscow to Gorkiy. Dipl. Ing. SPIEGEL was in this group. [redacted] 50X1-HUM

80. During [redacted] stay in the USSR [redacted] wrote several letters of complaint about [redacted] treatment and living conditions to the Ministry for Communications Equipment. These letters always ended with a request to be shipped home, and were signed by all members of [redacted] group. [redacted] never received answers to any of these letters. HOLZMUELLER wrote a letter directly to Stalin to complain about [redacted] treatment. It is possible that this was the reason why he was kept in the USSR longer than the rest [redacted] 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM 50X1-HUM

81. It was always desired that [redacted] sample condensers be made as small as possible, but requirements for actual miniaturization were never submitted [redacted] 50X1-HUM

82. [redacted] the Lenin Plant produced mica and paper capacitors (not metallized paper) only for its own consumption. 50X1-HUM

83. There was practically no technical liaison between the Frunze and Lenin Plants. [redacted] the initial intention was [redacted] to produce components at the Lenin Plant required fo[redacted] 50X1-HUM the apparatus development sections at Frunze. As it worked out, however, all procurement had to be accomplished through Moscow, and it was impossible for Frunze to place any direct orders with us. Dr. BAUER produced metal deposited resistors at the Frunze Plant in small numbers for their own use, which were similar to the ones produced by FALTER in his laborat[redacted] 50X1-HUM

84. Other products of the Lenin Plant included mobile electronic equipment, some of which [redacted] to be radar. [redacted] mili[redacted] 50X1-HUM tary trucks standing around the plant occasionally with electronic equipment installed inside them. [redacted] 50X1-HUM building belonging to the Lenin Plant [redacted] was the Personnel Department across the street [redacted] There [redacted] dealt with KUSMIN who was Chief of the Personnel Department.

 [redacted]

85. The only antennas [redacted] in the USSR were various simple wire antennas on the roof of the Frunze Plant. A large number of ballons were sent up from the Frunze Plant at various times [redacted] 50X1-HUM

50X1-HUM

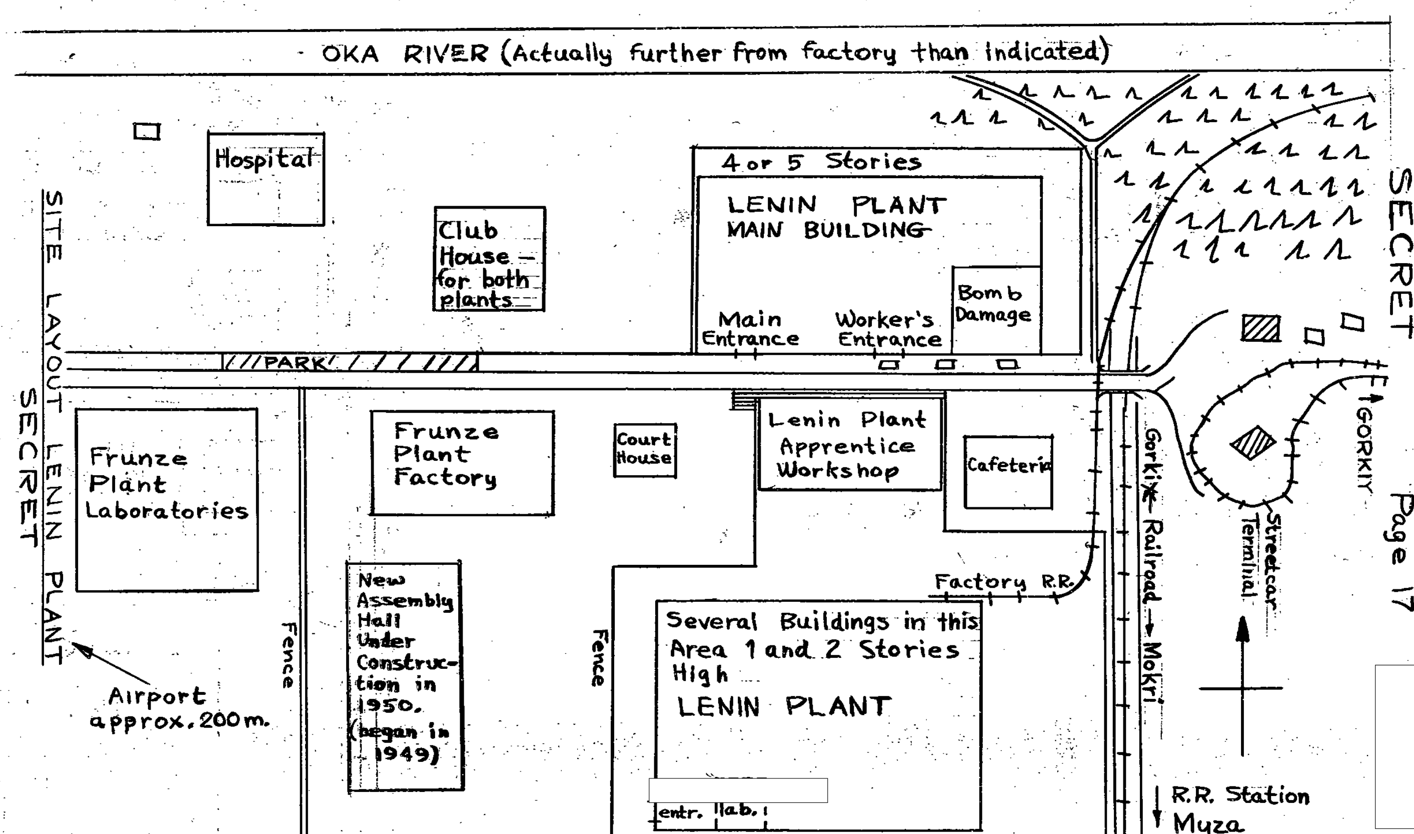
SHORTAGE OF RAW MATERIALS

86. Most raw materials were difficult to obtain to the required 50X1-HUM extent of quantity and quality. Polyvinylchloride was an 50X1-HUM extreme bottleneck in the iron electrolytic condenser development. [redacted] for a while [redacted] had to use a substitute material [redacted] 50X1-HUM

87. [redacted] the Soviet program of exploitation of German 50X1-HUM scientists was valuable to them, but not as valuable as it might have been. [redacted] if [redacted] had not been isolated and treated virtually as prisoners, [redacted] would have 50X1-HUM taken a far more cooperative attitude and accomplished considerably more technical work. While [redacted] initial atti- 50X1-HUM tudes toward the Soviets varied, almost everyone was thoroughly opposed to them by the time [redacted] repatriated. 50X1-HUM There was absolutely no enthusiasm for [redacted] work towards the end of [redacted] employment in the USSR.

88. [redacted] technically the USSR was somewhat below that of Germany. There seemed to be a great shortage of practical application engineers in the USSR. For this reason, even though their literature indicates possession of a considerable amount of technical knowledge, their products do not necessarily reflect this knowledge. One interesting point was that a chemistry professor from the Gorkiy University came to [redacted] laboratory 50X1-HUM several times in the capacity of a consultant to IKONNIKOV. [redacted] WERNER [redacted] spoke to him, and he appeared to be very 50X1-HUM capable in both theory and practice. This type of con- 50X1-HUM sultation by university professors appears to be quite common in the USSR. 50X1-HUM

[redacted]



50X1

50X1-HUM

Technical Director
BYELAYEV (БЕЛАЕВ)

Personnel Manager
KUSMIN

Chief of Development Department - MALIKOV

Condenser Lab.
IKONNIKOV
HERRMANN, Werner
WERNER, Paul
WACHENHUSEN, Christian
BIERSACK, Otto
11 Laboratory Assistants
2 Translators

Resistor Lab.
Mrs. FOMINA
FALTER, MATTHIAS
6-8 Laboratory Assistants

Design & Drafting (Konstrucktion)
4 Designers
4 Draftsmen
(All Soviets)

Experimental Work Shop (Model Shop)
KUSNETZOV
10 Mechanics
(All Soviets)

Ceramics Lab.
HOLZMUELLER, Werner
2 Soviet Engineers
5-10 Laboratory Assistants

50X1

ORGANIZATION OF LENIN PLANT, MYZA (near GORKI)

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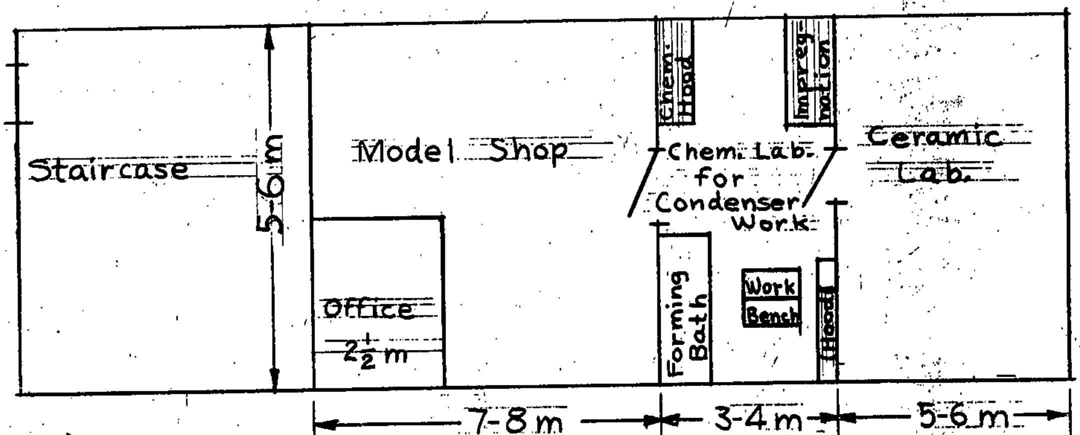
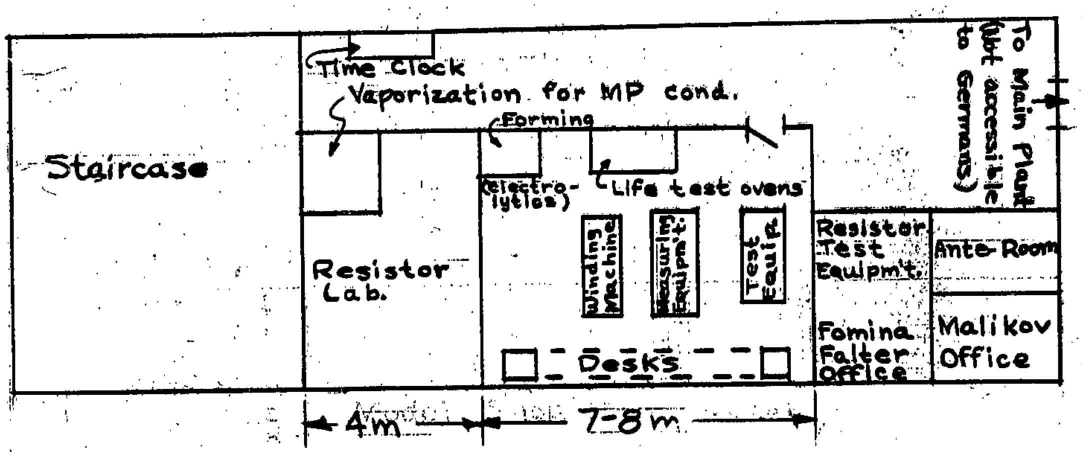


GROUND FLOOR (SEMI-BASEMENT)

SECOND FLOOR CONSISTS OF DRAFTING ROOMS



3RD FLOOR

FLOOR PLANS OF LABORATORIES OF LENIN PLANT, MYZA (NEAR GORKI)